Samsung DCS Application Note

No. 15 August 1998

Topic E and M Tielines

Introduction

- E&M Tielines are used to connect systems using E&M signalling
- E&M tielines allow connection between systems supporting E&M tielines and may be used for intercom calls, transferring calls and LCR applications
- E&M tieline ports can only be connected other E&M Tieline ports
- E&M tielines take trunk port positions and may be accessed using direct trunk selection, accessing a trunk group with the E&M tielines assigned or using LCR
- When an E&M Tieline is selected, dial tone is heard from the other system and DTMF can be sent to the receiving E&M Tieline port to access features such as internal calls or accessing a trunk on the remote system
- The Samsung DCS and the Samsung DCS 70 provide the option of using a translation table to interpret the incoming digits to the E&M Tieline port on the DCS. The translation table can be used in conjunction with LCR.
- Each E&M tieline card has four ports

Note that a four wire E&M Tieline circuit has six wires associated with it. The numbering refers to the number of wires used in speech circuits and not the E and M signalling wires.

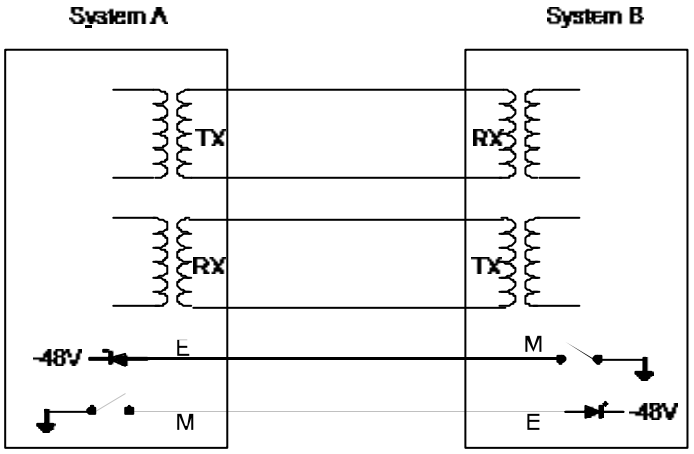


Figure 1 Four Wire E&M Tieline Circuit as supported on Samsung DCS and DCS 70

Connecting two systems using E&M Tielines

Connecting two systems using E&M Tielines can be done using three methods:

- Directly - if both systems are co-located

TX pair of system A is connected to the RX pair of system B
RX pair of system A is connected to the TX pair of system B
E lead of System A is connected to the M lead of system M
M lead of system A is connected to the E lead of system B

As per Figure 1 on Page 1

- Using Telstra Voicelink T - if network cable is required for connection

Cable the RX, TX, E lead and M lead to the MDF and tag them accordingly. Telstra then connect the circuits to their Voicelink T circuits. Telstra connect the six wires to an interface that converts the six wire circuit to two pairs using a cailho circuit and at the other end the two pair circuit is converted to a six wire circuit for connection to System B

- Using Frame relay or some other form of multiplexing that supports E&M Tieline interfaces

Connection using Frame Relay or similar should be done in consultation with the multiplexer installer/supplier. The cabling will involve using six wires.

Care should be taken to identify the leads as it is easy to become confused whether a pair tagged RX on the multiplexer should be connected to the RX pair or the TX pair of the DCS or DCS 70. Similar care should be taken when connecting the E lead and the M lead. Although it is unlikely damage could be caused by incorrect connections, the E&M Tieline will only work if connected correctly.

Installation

- E&M Tieline cards must be installed in DCS systems with Version 5 or later software and the DCS 70
- E&M Tieline cards may be installed in any universal slot in any DCS cabinet
- E&M Tieline cards may be installed in any universal slot in the DCS 70
- The method used to install E&M Tieline cards is the same as installing other cards, the system must powered off before installing or removing the cards
- If an E&M Tieline card is being added to an existing system, the procedures used are the same as adding any other card.

Power Off

Insert the card in a vacant slot

Power On

Pre-install using MMC 806 after selecting the appropriate cabinet and slot then press right hand soft key

Program the dial numbers in MMC 724

Tails and Connections

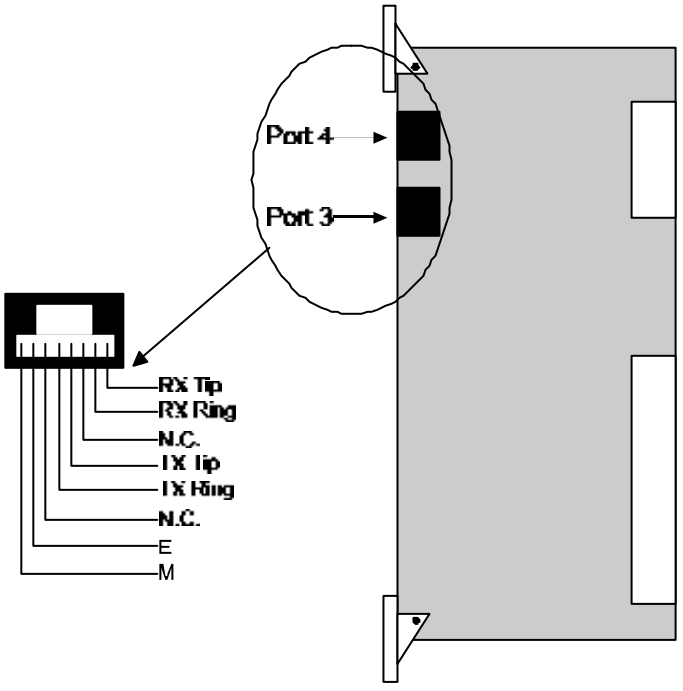
1. DCS 70

The DCS 70 connects the E&M Tieline cards using tails and RJ45 connections. Ports 1 and 2 on the cards are connected using the tails and ports 3 and 4 are connected using RJ45 connectors located on the cards.

Colour Code	KSU(P2) Slot #	EXP(P5) Slot #	4E&M Card Ports 1&2
White	SLOT#1	SLOT#4	not used
W/Brown	SLOT#1	SLOT#4	not used
White	SLOT#1	SLOT#4	not used
Br/Slate	SLOT#1	SLOT#4	not used
White	SLOT#1	SLOT#4	RX2 Tip
W/Slate	SLOT#1	SLOT#4	RX2 Ring
Yellow	SLOT#1	SLOT#4	M 2
Blue	SLOT#1	SLOT#4	E 2
Yellow	SLOT#1	SLOT#4	TX2 Tip
Orange	SLOT#1	SLOT#4	TX2 Ring
Yellow	SLOT#1	SLOT#4	RX1 Tip
Green	SLOT#1	SLOT#4	RX1 Ring
Yellow	SLOT#1	SLOT#4	M 1
Brown	SLOT#1	SLOT#4	E 1
Yellow	SLOT#1	SLOT#4	TX1 Tip
Slate	SLOT#1	SLOT#4	TX1 Ring

Colour Code	KSU(P2) Slot #	EXP(P5) Slot #	4E&M Card Ports 1&2
White	SLOT#2	SLOT#5	not used
S/Blue	SLOT#2	SLOT#5	not used
White	SLOT#2	SLOT#5	not used
W/Orange	SLOT#2	SLOT#5	not used
White	SLOT#2	SLOT#5	RX2 Tip
O/Green	SLOT#2	SLOT#5	RX2 Ring
White	SLOT#2	SLOT#5	M 2
O/Brown	SLOT#2	SLOT#5	E 2
White	SLOT#2	SLOT#5	TX2 Tip
O/Slate	SLOT#2	SLOT#5	TX2 Ring
White	SLOT#2	SLOT#5	RX1 Tip
W/Green	SLOT#2	SLOT#5	RX1 Ring
White	SLOT#2	SLOT#5	M 1
Gr/Brown	SLOT#2	SLOT#5	E 1
White	SLOT#2	SLOT#5	TX1 Tip
Gr/Slate	SLOT#2	SLOT#5	TX1 Ring

Colour Code	KSU(P2) Slot #	EXP(P5) Slot #	4E&M Card Ports 1&2
White	not used	not used	not used
Blue	not used	not used	not used
White	SLOT# 3	SLOT#6	not used
Orange	SLOT# 3	SLOT#6	not used
White	SLOT# 3	SLOT#6	not used
Green	SLOT# 3	SLOT#6	not used
White	SLOT# 3	SLOT#6	RX2 Tip
Brown	SLOT# 3	SLOT#6	RX2 Ring
White	SLOT# 3	SLOT#6	M 2
Slate	SLOT# 3	SLOT#6	E 2
White	SLOT# 3	SLOT#6	TX2 Tip
Wh/Blue	SLOT# 3	SLOT#6	TX2 Ring
White	SLOT# 3	SLOT#6	RX1 Tip
O/Blue	SLOT# 3	SLOT#6	RX1 Ring
White	SLOT# 3	SLOT#6	M 1
Gr/Blue	SLOT# 3	SLOT#6	E 1
White	SLOT# 3	SLOT#6	TX1 Tip
Br/Blue	SLOT# 3	SLOT#6	RX1 Tip



Connection the E&M Tieline cards on the DCS uses a 25 pair tail. All Four E&M Tieline ports are connected via the 25 pair tail. Note the E lead is connected to the mate, for example E&M Tieline port 1 has the E lead on the White wire and the M lead is on the Orange wire.

Colour	Amp Pins	Description
Blue/White	26,1	TX 1
Orange/White	27,2	E/M 1
Green/White	28,3	RX 1
Brown/White	29,4	TX 2
Slate/White	30,5	E/M 2
Blue-White/White	31,6	RX 2
Blue-Orange/White	32,7	TX 3
Blue-Green/White	33,8	E/M 3
Blue-Brown/White	34,9	RX 3
Blue-Slate/White	35,10	TX 4
Orange-White/White	36,11	E/M 4
Orange-Green/White	37,12	RX 4

Programming

The following MMCs are used with E&M Tieline cards:

MMC	Description
304	Keyset - Trunk Use
310	LCR Class of Service
400	Trunk ON/OFF
403	Trunk Toll Class
404	Trunk Name
408	Trunk Music on Hold
416	E&M DID table use
422	Trunk Class of Service
603	Trunk Grouping
710	LCR Digit Table
711	LCR Time Table
712	LCR Route Table
713	LCR Modify Route Table
714	DID Table

Description of MMCs

MMC 416

MMC 416 - Unuse DID Trans

When an E&M Tieline is selected dial tone is heard from the remote end. Digits dialled are used to access features on the remote system. For example if after selecting the E&M Tieline the digits 205 are dialled, keyset 205 is called.

MMC 416 - Use DID Trans

If the remote system has Use DID Trans programmed in MMC 416, digits received are translated using the DID table - MMC 714.

For example:

MMC 714 table has digit 8 corresponding to 205 during the day and 206 during the night in the remote system. When the E&M Tieline selected and the digit 8 is sent to the remote site, keyset 205 will be called during the or if the remote system is in Night Service, 206 will be called. MMC 714 also has the ability to delete digits and show a name.

Other MMCs

Other MMCs are used as they would be used for PSTN or ISDN trunks

Example

This example shows how two systems can be connected using an E&M Tieline. The programming for this example is very basic. For more flexible and elaborate networking, LCR and VPN programming may be used.

System A

Dial Numbering plan is changed so that all keysets are in the 200 range, no keysets in the 300 range.

Program the E&M Tieline in Trunk Group 3.

Program MMC 416 so the E&M Tieline is set to USE DID.

Program MMC 714 as follows:

DID Digit	Digit	Day Dest	Night Dest
001	01	201	201
002	02	202	202
003	03	203	203
004	04	204	204

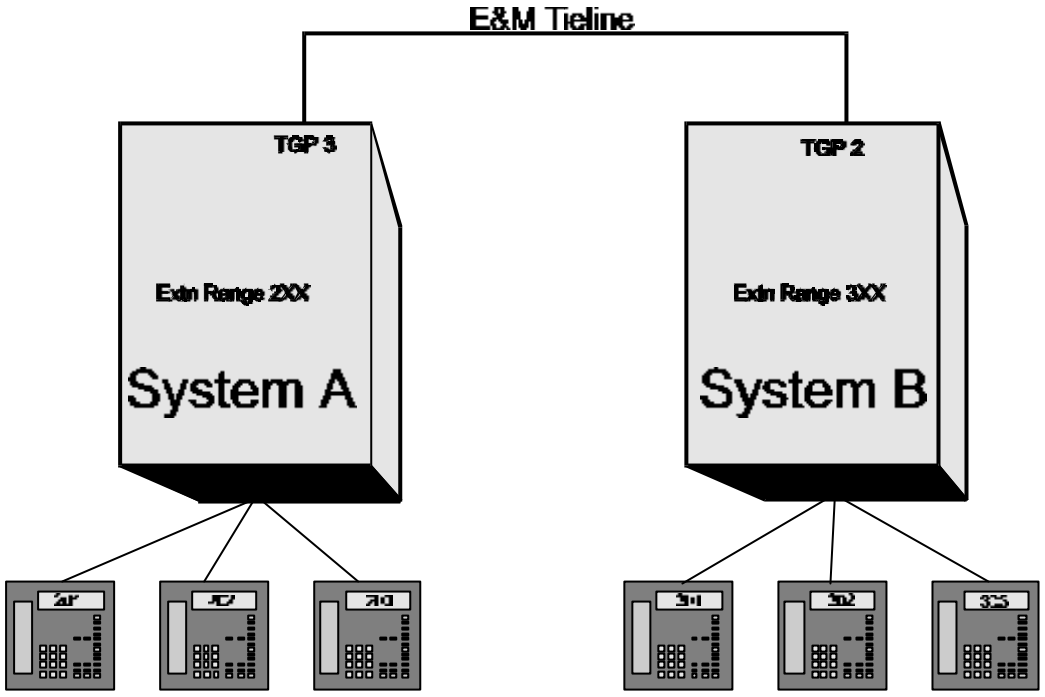
System B

Dial Numbering plan is changed so that all keysets are in the 300 range, no keysets in the 200 range.

Program the E&M Tieline in Trunk Group 2.

Program MMC 416 so the E&M Tieline is set to USE DID.

DID Digit	Digit	Day Dest	Night Dest
001	01	301	301
002	02	302	302
003	03	303	303
004	04	304	304



Operation

When a keyset connected to system A dials for example 302, the digit 3 selects the E&M Tieline, digits "0" and "2" are then sent to system B via the E&M Tieline. Because the E&M Tieline port on system B has been programmed as USE DID, the DID table is used and the call is sent to keyset 302.

A similar operation is used calling from a keyset on system B to a keyset on system A.

A shortcoming with this arrangement is the users must pause after dialling the first digit until dial tone is heard from the other system. More elaborate networking can be achieved using E&M Tielines, LCR and VPN programming.

How E&M Tielines Work

Referring to Figure 1on Page 1, the Transmit pair of one system is connected to the Receive of the other system and the E lead of one system is connected to the M lead of the other system.

Signalling sequence for System A calling System B

System A operates the contact to place an earth on A's M lead and B's E lead.

System A can send digits in either decadic or DTMF. If decadic dialling is used, the decadic pulses are sent on system A's M lead and received on system B's E lead. If DTMF signalling is used, the DTMF tones are sent on System A's Transmit pair and received on System B's Receive pair.

When system B answers the call, System B applies an earth to system B's M lead and system A's E lead.
If system A decides to abandon the call, System A removes the earth form system A's M lead.

When a call is in progress, there is an earth on both M leads.

When the call has been completed, both system A and system B remove the earth from their M leads.

E&M Tieline Fault Finding

- Using the circuit diagram on Page 1, a resistance measurement across the Transmit pair or the Receive pair will indicate a resistance of approximately 58 □.

- Voltage measurements between earth and the M lead will show a D.C. Voltage of 48 Volts when the tieline is idle and zero volts when the Tieline is selected if the Tieline is correctly connected to another E&M Tieline.

- To identify which is the Transmit pair or the Receive pair coming from the remote end:

  Monitor the transmit pair and Receive pairs with a buttinski.

  If the E&M Tieline at the remote end is selected and digits pressed, DTMF will be heard on the transmit pair coming from the remote end. This pair must be connected Receive pair of the near end.

  Similarly the transmit pair from the near end will send DTMF if the E&M Tieline is selected and digits are dialled.

- If problems exist after making the connections to voice link T or another system directly, connect two E&M Tieline ports together from the same system to identify where the problem exists.